Modern Concepts of Cardiovascular Disease

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THE CLINICAL SIGNIFICANCE OF HYPOTENSION

Low blood pressure is not a disease. It is true, however, that it is in many instances part and parcel of a diseased bodily state. It is established that distinct hypotension (systolic pressure of 100 mm. Hg. or less) is at times compatible with perfect health. Statistical studies covering many thousands of apparently healthy young adults have shown that hypotension is quite common, being found in 2.5 to 3.5 per cent of all persons examined. It is also true that many hypotensive subjects are very robust and possess great bodily vigor. Racial, environmental, and climatic conditions may change the normal average of blood pressure in young adults. Study of a series of large groups of preferred life insurance risks revealed the fact that hypotension in healthy adults is not only common, but that, in the opinion of insurance medical experts, the low blood pressure adds to, rather than detracts from, the normal life expectancies.

Various authors have tried to fix upon a single cause to explain diverse types of hypotension. This cannot be done. The interrelationship of the factors maintaining normal blood pressure is always close, and at times the connections are devious and hard to trace. For certain types of hypotension no adequate explanation has yet been found. The relation of the endocrine system to types of hypotension is an instance in point. In the syndrome known as "essential hypotension," the pathological physiology is not at all clear, and it has yet to be proved that the low blood pressure is the cause of all of the symptoms.

Any discussion of types of hypotension must concern itself with a consideration of those factors which maintain normal blood pressure. These factors are: (1) The force of the cardiac contraction, the vis a tergo; (2) the condition of the vessel walls; (3) the peripheral resistance to the blood stream, determined by vasomotor tone; (4) the blood volume, and the physical state of the blood itself, its viscosity, etc. These factors are *not* of equal importance. A weakened myocardium certainly causes definite types of hypotension. The low blood pressures in certain acute infectious diseases, and in certain chronic conditions where the myocardium is weakened, are instances of hypotension due to the cardiac factor. The condition of the vessel walls probably plays little role, except in certain forms of temporary hypotension. The factor of peripheral resistance is probably the most important single factor, both in the maintenance of normal pressure and in the production of hypotension. The endocrine system works in conjunction with the vasomotor system, exerting either a pressor or a depressor action in vasomotor function. The capillaries play a very important part in the production and maintenance of vasomotor tone. Sudden changes in the tone of the abdominal vessels are particularly apt to produce sudden hypotension. Capillaries possess powers of dilation and constriction independently of the arterioles. Normally the capillaries maintain a state of constriction. Nervous and chemical stimuli enter into the mechanism of capillary constriction and dilatation. Nervous stimuli cause only constriction, while chemical stimuli may mediate either constriction or dilatation. The fourth factor, change in blood volume and in blood viscosity is of considerable importance in the production of certain types of acute hypotension, as in certain of the acute infections and notably in shock.

Types of Hypotension. Low blood pressure may be either a temporary or a persistent phenomenon. Acute hypotension is part and parcel of anaphylactic, surgical, traumatic, anesthetic and medical shock. It occurs in certain of the acute infectious diseases. It may be the result of drug intoxication. Persistent hypotension occurs in association with certain chronic infectious diseases and cachectic states. It is found in such diatheses as status lymphaticus, infantilism, and myxedema. Lesions of the circulatory system, particularly of the myocardium, may produce either temporary or persistent hypotension. Persistent hypotension may be due to abnormal vasomotor tone due to changed condition of the capillary circulation. It occurs in conditions of endocrine gland dysfunction, especially of the adrenals, pituitary, thyroid and gonads. Discussion of all of these types is manifestly impossible here, but attention may be called to certain salient facts.

Wound (and Surgical) Shock. One point stands out in the genesis of this condition, and that is that there is a marked reduction of blood volume. As

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Atchley has put it, tersely, "the vascular bed becomes larger than the blood volume." It is this reduction of blood volume which is of importance from a clinical standpoint, not only from the viewpoint of etiology, but also from the equally important standpoint of treatment. Reduction in blood volume is due to stagnation of blood in the capillary areas and escape of plasma from capillary channels. The most important measure in the treatment of shock, in addition to external heat, rest and sedatives, is to increase the blood volume. This can be done by the intravenous use of dextrose and saline solutions, solutions of salt and acacia, or by transfusions.

Medical Shock, a term comparatively rarely heard, connotes for the internist the equivalent of surgical shock. It is a serious, often a fatal condition, characterized by vasomotor collapse, drop in blood pressure, and consequent failure of the circulation. It is by no means always due to cardiac failure per se. Death in pneumonia, for instance, is frequently attended by the signs and symptoms of shock. Clinicians have long been accustomed to rate the degree of toxicity by the severity of these shock symptoms. This has been formulated into a prognostic dictum by Gibson. Systolic blood pressure as expressed in mm. Hg. falling below the cardiac rate in beats per minute, is of grave prognostic omen. The acidosis of diabetes also presents a clear cut example of medical shock. The shock in diabetic coma is due, largely, to diminution of blood volume from dehydration. It must be remembered, however, that in diabetic acidosis the aceto-acetic acid may play a role in producing a partial vasomotor paralysis, which complicates the situation. The marked drop in blood pressure in the early stages of coronary thrombosis is often attended by the signs of medical shock. In the acute infectious diseases, so far as shock and drop in pressure are concerned, the weight of evidence would indicate that there is a capillary paralysis, induced by bacterial toxins, through the medium of vasomotor paralysis.

Addison's Disease. Marked hypotension is one of the outstanding clinical features of Addison's disease. It is, however, impossible to explain perfectly the hypotension of this disease in terms of dysfunction of one or of several of the factors which ordinarily maintain normal blood pressure. But it is of interest to note that the improvement which has followed the use of the hormone from the adrenal cortex has been accompanied by rise in blood pressure.

Essential Hypotension. Various authors have called attention to a syndrome whose chief objective finding is marked hypotension. Physical examination shows no organic lesion. The subjects complain of headache, vertigo, palpitation on exertion. There is marked fatigability, mental and physical. The appetite is capricious, dyspepsia is the rule. The patients are generally neither neurasthenic nor psychasthenic and the cases cannot be classed under the psychoneuroses. Various theories have been advanced to explain the marked hypotension. Obscure focal infection, respiratory deficit and decreased oxidation, and endocrine disturbances are all adduced as causes. Mosenthal thinks that the hypotension is due to the storage of excessive quantities of blood in the splanchnic pool. Greaves also calls attention to the importance of the splanchnic pool in relation to hypotension. Friedlander has suggested a theory of capillary stasis which might fit with these theories. According to this view the capillary stasis is due to the giving off of small quantities of histamin, or histamin-like bodies, which act as capillary poisons. It is known that histamin is a widely distributed constituent of animal tissues; it is present in the mucosa of the small intestine. It is admitted that much work must be done before this hypothesis may be said to rest on the basis of established fact.

Treatment. When one comes to the treatment of low blood pressure (in those cases needing treatment), it is apparent that, to be successful, it must be based on the amelioration or removal of the cause. Inasmuch as it is certain that there is no single cause for hypotension, it becomes a matter of paramount necessity to determine the type. We must ascertain which of the factors ordinarily maintaining normal pressure, or which combinations of them, are in dysfunction. Such a conception immediately explains the failure of mere drug therapy, except in certain very specific instances such as Addison's disease. For the temporary hypotensives, so far as they actually need treatment, therapy directed to the underlying cause will usually be effective. If the cardiac factor be involved, as it is in certain acute infections, appropriate measures to increase the force of the cardiac contraction will suffice to raise the blood pressure. If the volume of the circulatory blood be lowered, as in cases of shock, intravenous injections of fluid or blood will help. It is here that certain drugs, notably ephedrin, and certain hormones such as epinephrin and pituitary extract, have great value as adjuvants. For the large group of cases of persistent hypotension, the problem of therapy remains difficult just as long as the determination of the cause remains obscure. Moreover it must be remembered that in those groups of cases where we have reason to believe that the low blood pressure is due to loss of vasomotor tone (itself induced by capillary stasis) we have as yet no perfectly satisfactory method of treatment. Assuming, as some of us do, the importance of what may be called histamin capillary poisoning, it must be admitted that a rational, successful therapy has yet to be worked out. It should be remembered that progress in the study of low blood pressure can come best through correlation of effort of physiologists, chemists, pharmacologists, pathologists and clinicians. In such studies there must be neither ignorant credulity nor cynical intolerance.

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